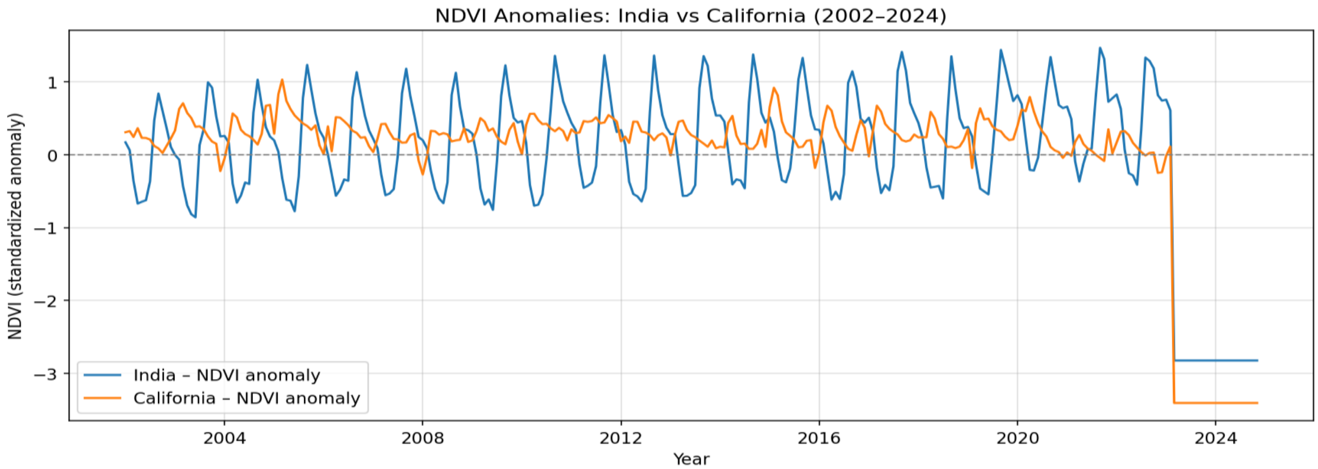
# Independent Research Summary

## Vegetation Drought Sensitivity Across Contrasting Climate Regimes (2002–2024)

**Tanya Dhaka**

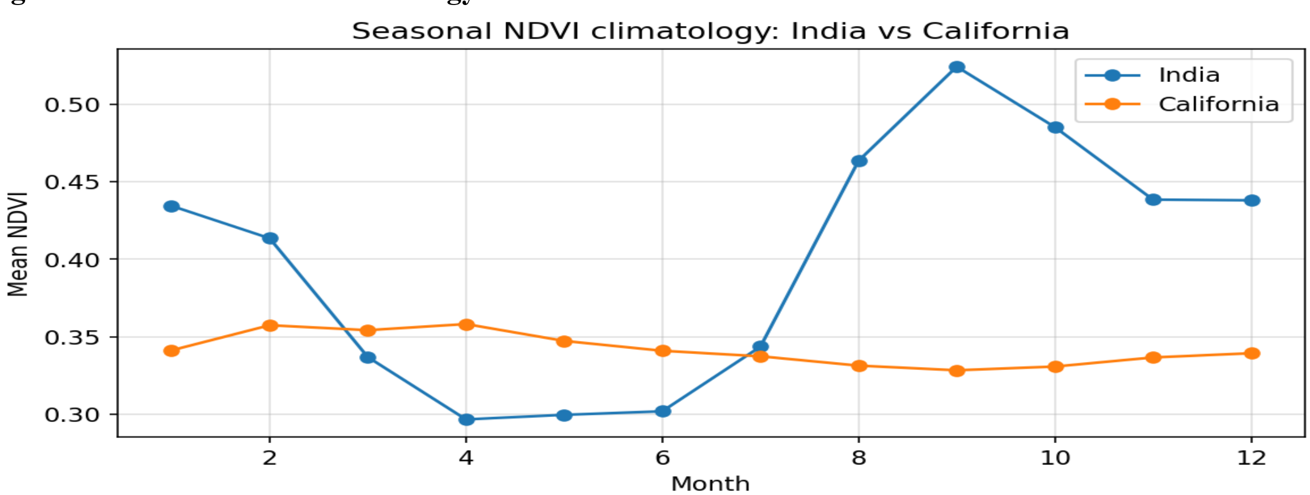
I conducted an independent comparative analysis of vegetation drought response across two climatically distinct regions: the monsoon-driven Western Ghats of India and the Mediterranean climate of Central California. Using a unified Google Earth Engine workflow, I developed monthly time series of NDVI, rainfall, vapor pressure deficit (VPD), and soil moisture from 2002–2024. I generated anomalies, derived seasonal climatologies, and computed climate-vegetation lag correlations to identify the dominant environmental controls on ecosystem productivity.

**Figure 1. NDVI Anomalies, India vs. California (2002–2024)**



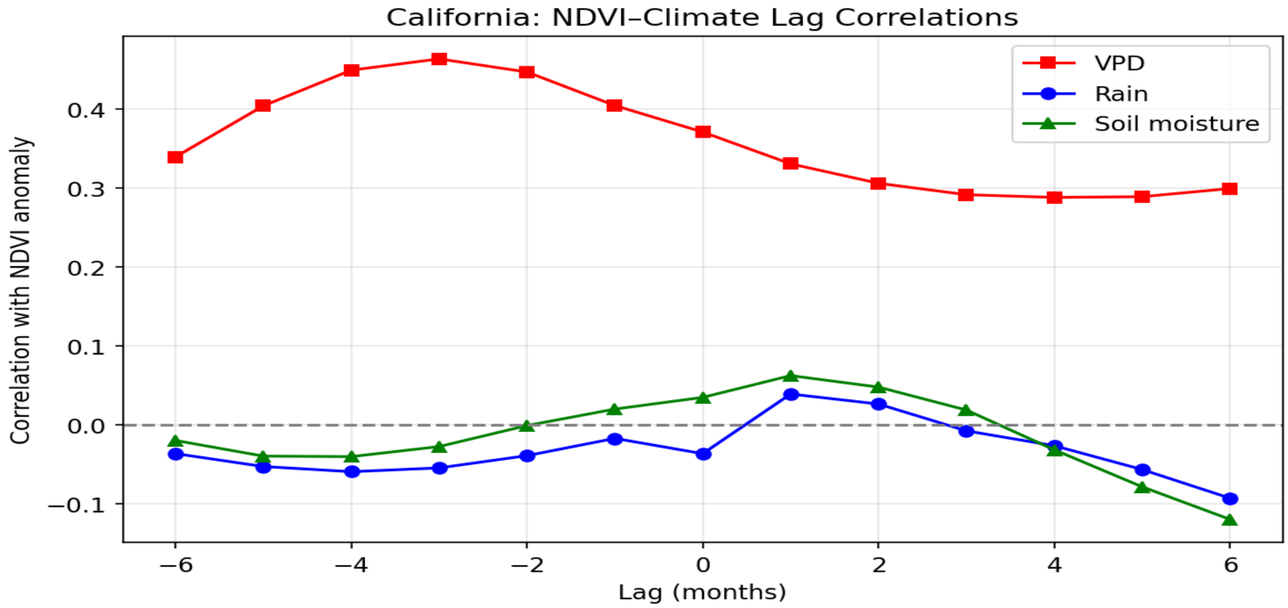

The NDVI anomaly record reveals sharp contrasts in ecosystem sensitivity. California shows deep, multi-year vegetation declines during major droughts (2012-2016; 2020-2021), reflecting strong vulnerability to sustained atmospheric and hydrological stress. India's NDVI variability is more tightly synchronized with monsoon rainfall, with rapid greening and recovery during years of strong precipitation.

**Figure 2. Seasonal NDVI Climatology**



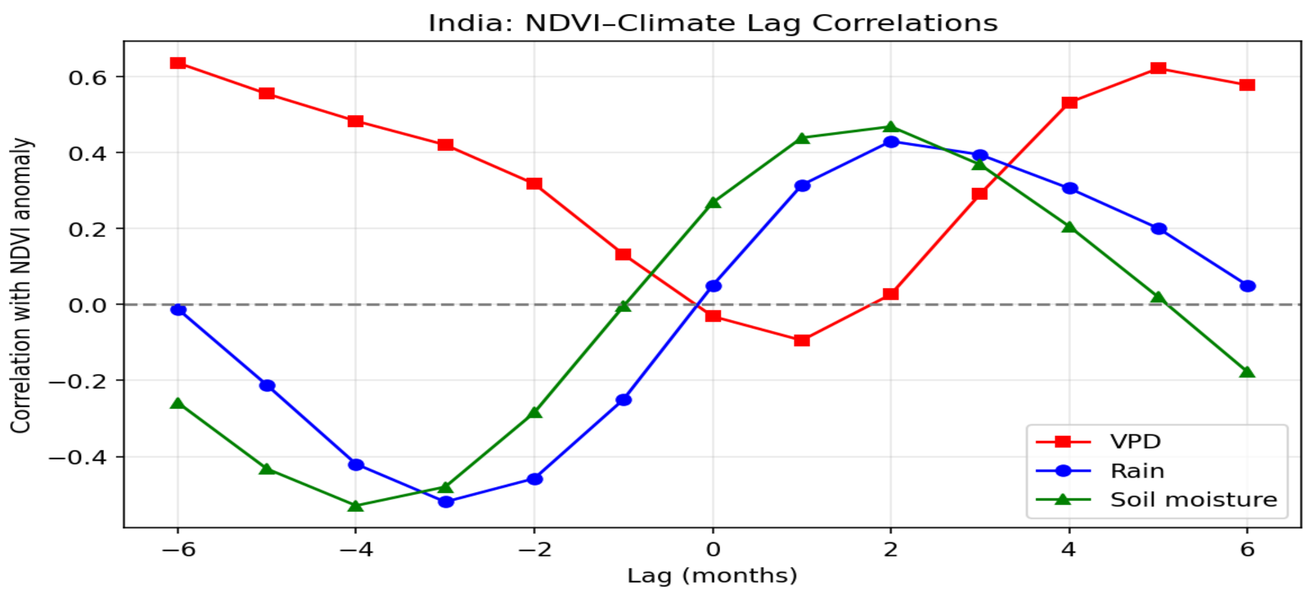

Seasonal cycles further distinguish the two systems: India exhibits a pronounced monsoon-driven productivity peak, while California shows a winter-spring peak followed by summer senescence under high VPD.

**Figure 3. California NDVI–Climate Lag Correlations**




In California, NDVI is strongly and negatively correlated with VPD at short lags (≈-0.65), identifying atmospheric dryness as the dominant stressor. Soil moisture exhibits a weaker positive relationship, suggesting partial hydrological buffering.

**Figure 4. India NDVI–Climate Lag Correlations**




In India, NDVI responds most strongly to rainfall at 0-1-month lags (r ≈ +0.70), reflecting direct monsoon control on vegetation productivity.

Additional figures, including rainfall, VPD, and soil-moisture lag correlations as well as extended anomaly and seasonality analyses, were also produced. The study highlights two distinct resilience pathways: a precipitation-driven system in India and a vapor-pressure-deficit-dominated system in California. Together, these results illustrate how ecosystems shaped by monsoon rainfall versus atmospheric drought express fundamentally different resilience mechanisms, a distinction with implications for forecasting climate-driven vegetation change.